Central Perk Technical Report

Ryan Burger, Sherry Tang, Farhad Mughal, Yuanzhe Wang, Vikram Payyavula

3/24/2021

Contents

Business Problem

Central Perk coffee shop is looking to uncover insights into the spending patterns of its customers. Our goal is to identify which customers are most loyal to the shop. After making this distinction, we will determine whether there is more to gain by improving sales from loyal customers or non-loyal customers. We can examine the trends of our group of choice and explore their shopping trends. With that information, we can find areas of improvement and instill solutions to smooth demand and improve the overall profit of Central Perk.

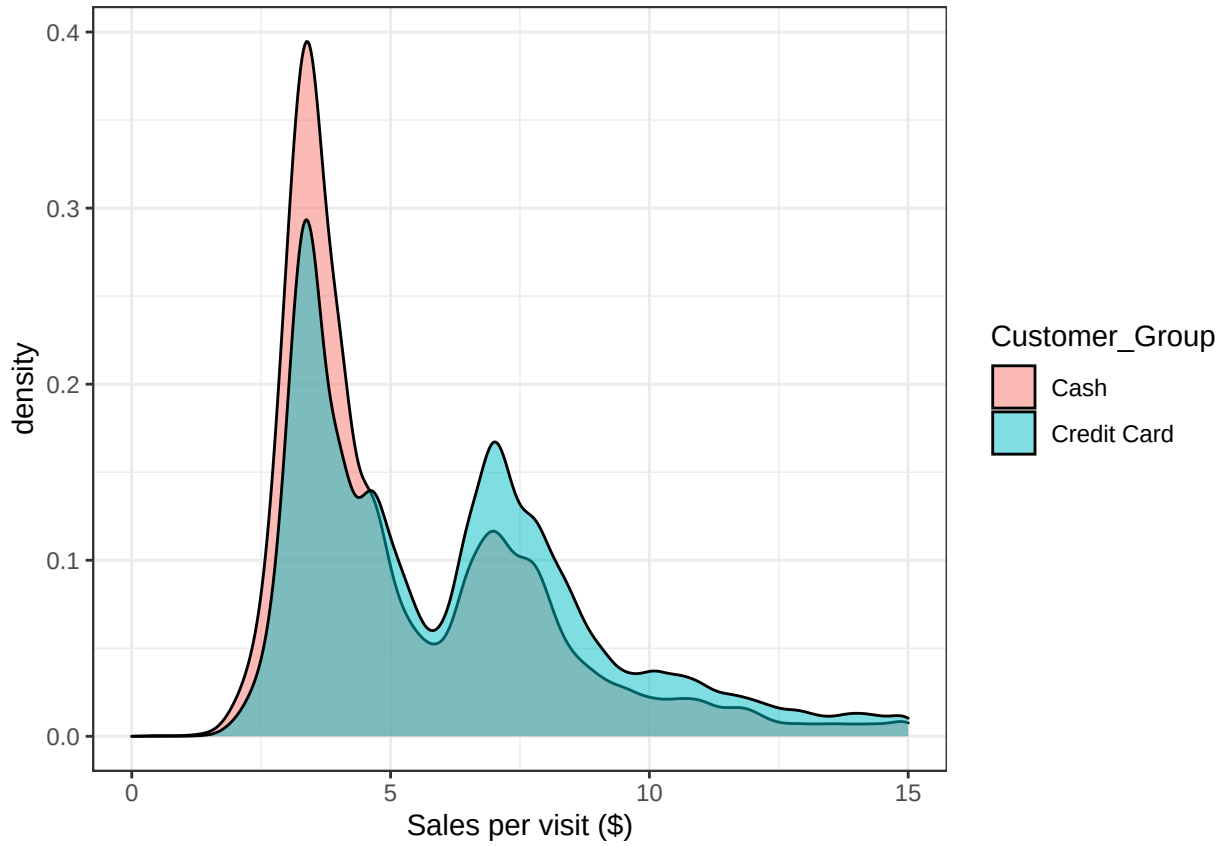
Thesis

We found that Central Perk's loyal customers are very valuable and their shopping trends can be leveraged to increase profits and smooth demand. Traffic from loyal customers is the highest in the morning; a considerable portion of the loyal customers are commuters. Based on our findings, the coffee shop can implement several strategies to smooth the demand and generate more revenue from loyal customers. In the morning, they can offer bundle sales and a pre-order service to improve efficiency. In the afternoon, they can offer coupons for whomever purchased coffee in the morning and provide free delivery service to stimulate consumption. By implementing the above strategies, the coffee shop can largely improve the morning operation efficiency and potentially increase afternoon demand by 41% and increase overall sales by 19%.

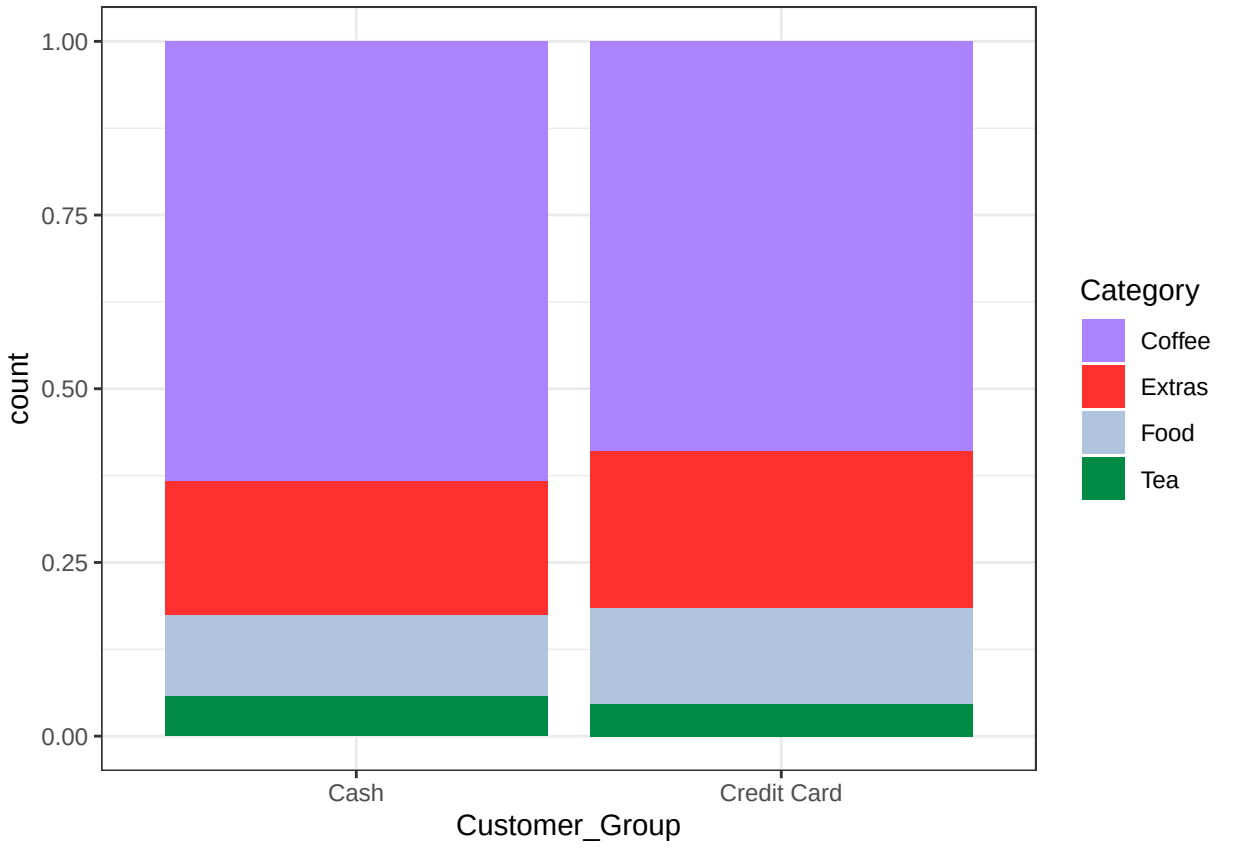
Assumptions

When customers pay with a credit card, they are assigned a customer id. We perform our analyses on only those transactions that feature a customer id, as it allows us to assess trends on an individual customer level. To follow through with this, we assume that the shopping trends are similar among those who use a credit card and those who use cash.

We looked at the spending patterns of customers who paid with credit card or with cash. The plot below shows the distribution of the amount spent at each visit between the credit card and cash users. The distributions are quite similar. There is a slight difference between customers purchasing with a credit card and cash users. Credit cards users have, on average, more visits where they spend $4+, and cash users have more visits spending less than $4. On average, they spend $6.71 per visit, while customers using cash spend $5.68 per visit



Likewise, the types of items being purchased are mostly similar. The figure below shows the proportion of different food items purchased by both groups. Tea and food show a similar amount between credit card and cash users. The main difference is that credit card users tend to add more extras (ice, an extra shot, etc.) to their drinks. This does not lead to a substantial difference in the the spending habits, however.



Given that credit card purchases make up almost 2/3 of the purchases, we feel that their spending patterns will provide a good representation of the entire customer-base.

Measurements

To define "customer loyalty", we employed the Recency, Frequency, Monetary Value (RFM) framework. We evaluated each customer's performance on these individual benchmarks and calculated a composite score. For recency, how many days have passed since the customer's most recent visit until August 24, 2018. For the frequency, how many items have the customer purchased over the timeframe of the data? Lastly, the monetary value is defined as how much each customer has spent per item from Central Perk.

These categories are converted into percentiles, where 1 (99th percentile) represents the highest value and it decreases accordingly. The percentile represents how a customer fares with respect to other customers. eg. The 95th percentile customer means that the customer ranks better than 95% of the customers using this framework. The formula using to combined the 3 metrics is:

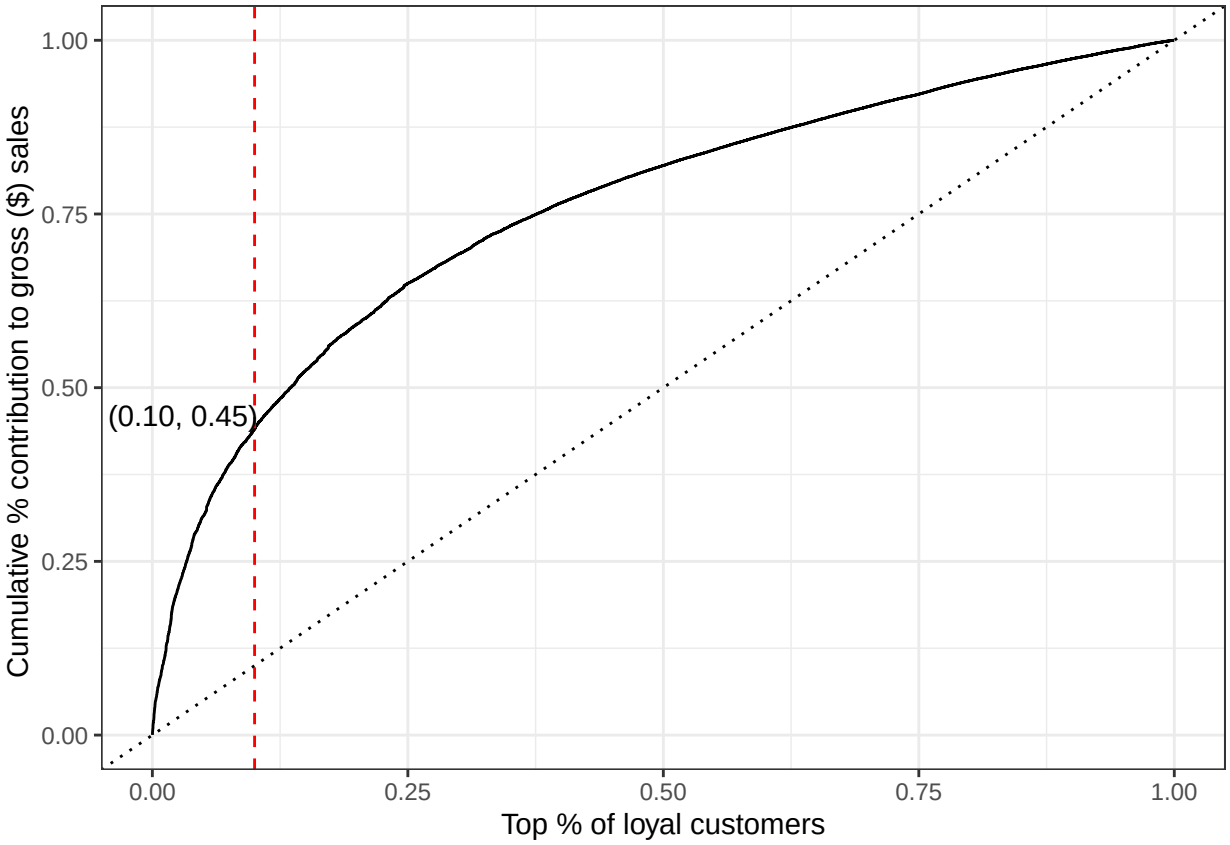
$$RFM = \sqrt{R^2 + F^2 + M^2}$$

Logic Chain

Question 1: How do we define loyal customers?

Using the RFM metric, we had to identify which customers would qualify as "loyal." The plot below shows the cumulative spending of customers, ranked by loyalty (RFM). The x-axis tells us what percent of the customers are accounted for at any specific point. For example, the dashed red line is at 0.10, which signifies

the top 10% of loyal customers. The y axis represents the percentage of the overall spending of those customers. In this example, the top 10% of the loyal customers account for 45% of the total sales of Central Perk.



Using this curve, we can select an appropriate cutoff to select our loyal customers. Whichever cutoff is chosen will be inherently arbitrary, but we can still make an educated decision. It is important that we don't label too many of the customers as loyal. We want to be able to differentiate who the customers are that have predictable and actionable trends. We also want to select a large enough amount of the customers that will have an actual impact on the sales of the store. We elected to set the 10% as the cutoff for the loyal customers. As specified above, this can give us roughly 45% of the total sales of the shop. This includes over 3000 customers who account for more than 16,000 transactions, which indicates a substantial sample size. Going forward, we will consider those customers that are in the top 10% of the RFM metric to be classified as "loyal," while the rest are referred to as "non-loyal."

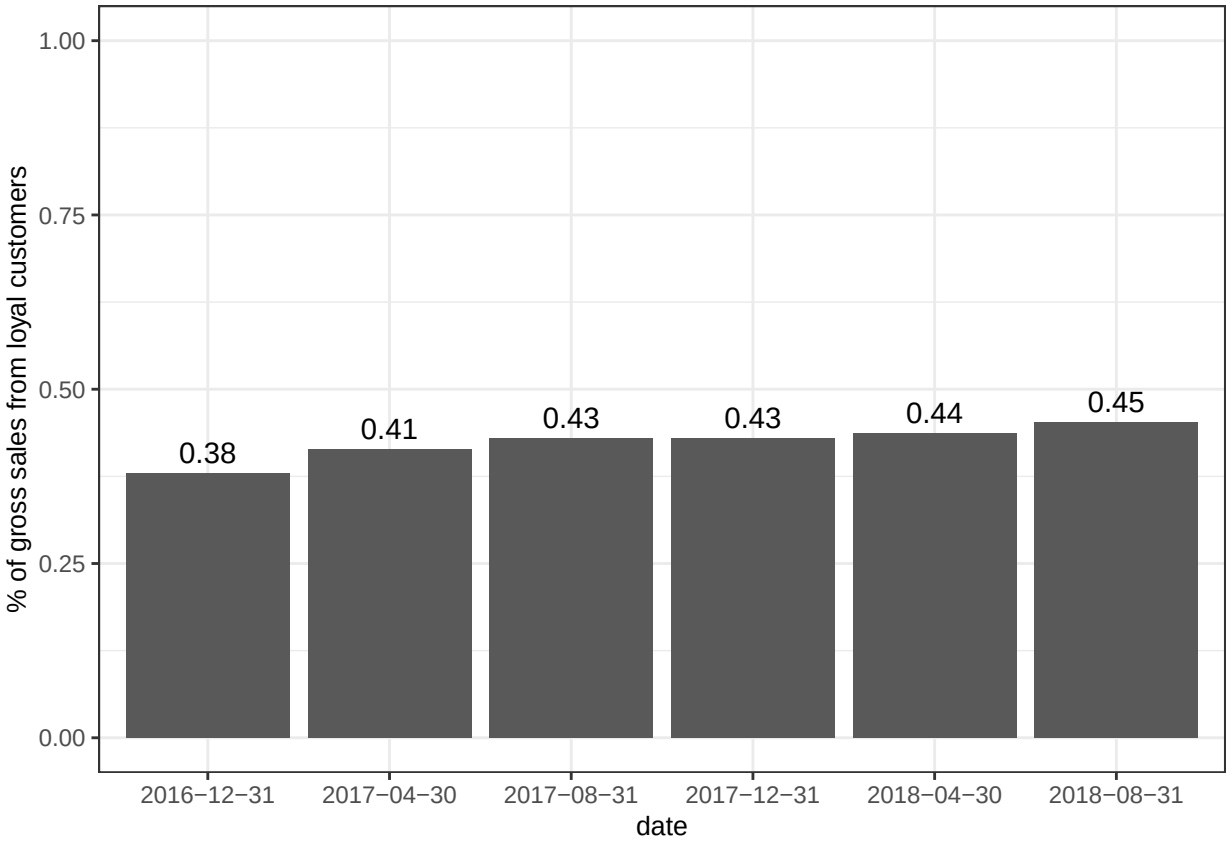
Question 2: Should we focus on loyal or non-loyal customers?

As we develop strategies for Central Perk, we need to narrow our focus to provide clear, actionable recommendations. Central Perk can look to improve its standing with its already loyal customers, or try to turn infrequent, non-loyal customers into loyal ones. Due to the reasons listed below, we will gear our strategies toward loyal customers.

1. Increased profitability
   Evidently, our loyal customers generate more revenue than non-loyal customers. Based on our analysis, as of August 24, 2018, loyal customers made up to 10% of total customers but they contributed 45% of the total gross sales. The average monthly spending of loyal customers is $16.36 which is much higher than that of non-loyal customers($0.74). Moreover, in a renowned study by Bain and Company, it was

found that a mere 5% increase in retention rates can increase your profits by up to 95%. Compared to new customers, repeat customers tend to spend more and are more likely to try new products.

2. Lower costs
   According to the study by Bain and Company, it can cost upto 5 times more to acquire a new customer than it does to retain an existing customer. Your existing customers already know about your products and services – so why not gear efforts towards retaining them, rather than focusing solely on marketing to potential new customers? [1]
3. More predictable
   Based on the data given, there is no certain purchase pattern for non-loyal customers, their purchase choice is more random. However for loyal customers, there are obvious purchase patterns which can reveal more ground truth about the coffee shop and contribute more to the analysis since it exclude the noise brought by non-loyal customers.
4. Growing loyal customer base
   Central Perk has seen its loyal customers' contribution to the overall sales increase over time, as evidenced in the following graph:

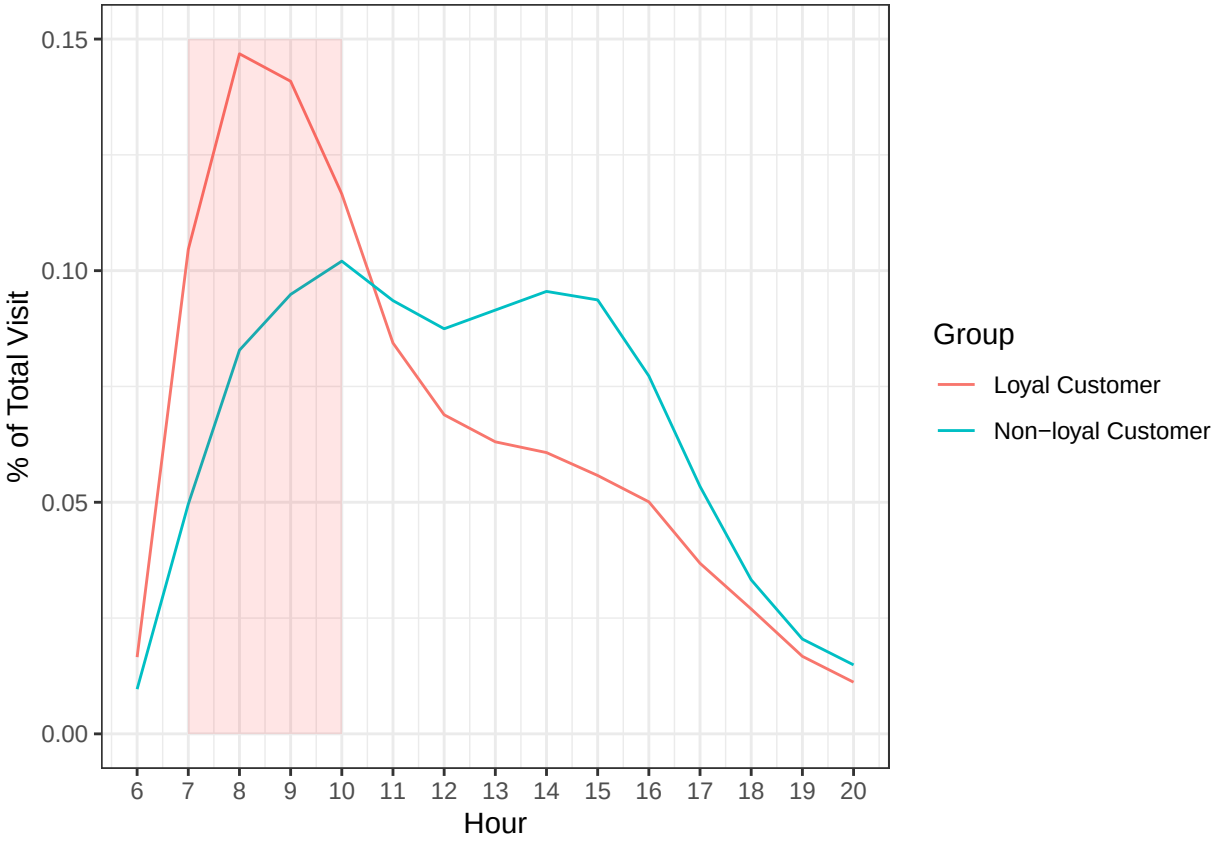


The plot shows what percent of teh incoming revenue has come from loyal customers. The loyal customers' share of the gross sales started at 38% and climbed to 45% over the course of the data collection timeline. Every 4 months saw an increase or maintained proportion of revenue come from loyal customers.

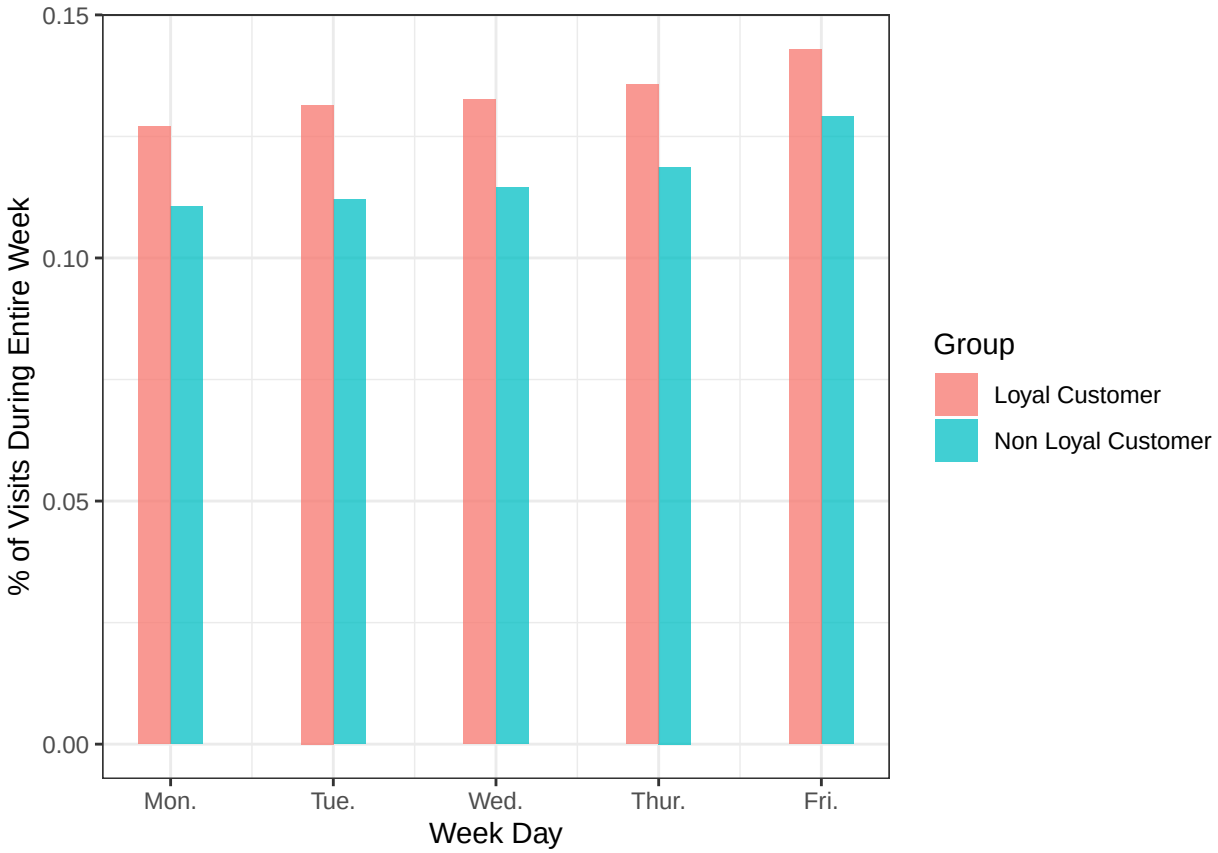
Now that we have identified loyal customers as the main focus, we want to explore the characteristics of the loyal customers: which items do they prefer, when do they tend to visit the shop, etc. These characteristics and patterns will give us insight into who the loyal customer group is and how we can leverage their shopping trends to keep these customers loyal to the coffee shop.

Question 3: What are the characteristics of Loyal customers?

Loyal customers seem to prefer visiting the coffee shop during the morning while non-loyal customers show a more random visit pattern throughout the day. Data shows that 72.8% of the loyal customers purchase coffee in the morning and 57% of the total sales from loyal customers is generated from 7 AM to 9 AM in the morning which is often the start of the workday for commuters. The graph below shows the visit pattern of loyal customers in the pink line peaking in the morning hours while the blue/green shows the visit pattern of non-loyal customers.



Also, loyal customers are more likely to purchase coffee during weekdays than non-loyal customers. Below graph shows the visiting pattern of loyal customers in pink and non-loyal customers in blue during the weekdays.



Based on our analysis of New York coffee drinkers, it is likely that most of the people who buy coffee during the morning on weekdays are morning commuters. We researched some data from New York commuters and we estimated that 63.4% of the people who buy coffee in the morning are commuters. The data used to make this estimation came from the Census Bureau, the state of New York, the National Coffee Association, and Times Union.

In summary, compared with naive choices of non-loyal customers, loyal customers tend to visit the coffee shop more often during the weekdays and during the morning. It is likely that the loyal customers group might be those commuters who grab a coffee or food on the way to work.

Now that we have analysed that our customer base of top 10% of loyal customers generate around 45% of revenue and this revenue is mostly from the sales conducted in the morning hours, we would like to explore how we can diversify the buying patterns of these loyal customers in the non-morning hours. This might increase sales from our loyal customers in the non peak hours. The following questions explore those options. Hence, the next question would be how to maximize the sales throughout the day.

Question 4: What strategies exist for different times of the day?

As evidenced above, our loyal customer traffic and their accompanying shopping trends peaks in the morning and then tends to change and tapers off throughout the day. Hence, we devise different strategies for different times of the day.

Morning

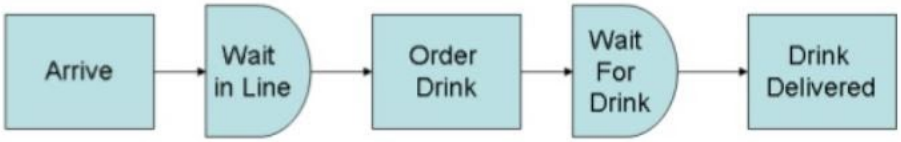
As the coffee shop is already seeing a peak in the morning hours, the average order serving time might be higher. Data shows that during the morning (6 AM-10 AM),on average, there is one customer every 32 seconds. However, the average time to get a coffee can be around 9 minutes, with the range spread between 7 minutes (best) and 14 minutes (worst) [2]. This time mismatch will cause a long waiting time. Furthermore,

due to this increased serving time and high traffic rush in the morning hours, the coffee shop might miss on some orders too. Commuters might not have enough time to wait for an order so some of them could possibly switch to competitors. To mitigate this situation and not lose customers or potential sales, we suggest the coffee shop owners provide a pre-order service [3] and bundle certain items together.

Pre-ordering coffee: By including a pre-ordering feature for our customers, we essentially allow our clients to jump the queue and have their coffee steaming hot, ready, and waiting for their arrival. This can be a key factor for boosting that all-important customer loyalty, as a pre-ordering feature makes the customer wait less to submit his order. This can also help him/her to choose to look at the options beforehand in case they want to order something other than the usual coffee or item [4].

Starbucks drew attention in 2014 when it announced an app that would allow iPhone users in Portland to order and pay for their coffee before arriving at the store. (They've since expanded to almost 10,000 other locations.) Taco Bell, Wendy's, and Burger King have also launched apps that allow mobile ordering, and Subway joined the crowd this July 2015 expanding to almost all locations, signifying the success of pre-ordering [5].

A general process for ordering coffee at the shop look like this:



According to an experiment conducted by Starbucks, average wait time is 4.12 minutes [6] (We are operating under the assumption that the waiting time for coffee in this experiment is the same as our coffee shop too]. A pre-ordering system that is 50% efficient would reduce this time to 2.11 mins. From the coffee shop perspective, the data reveals that the average number of orders is around 2 per minute. Hence, if we can save 2.11 on each order (picking the lower limit), we can have an efficiency of 2.11 * 2 * 60 = 253.2 mins in all orders processing in an hour.

An app can work well for the coffee shop staff, too. Pre-orders can be dealt with swiftly and efficiently by a dedicated team member, which offers the possibility of speeding up the order-taking process, making more money through more orders, and not having too many people to wait before submitting an order, thus in turn keeping them happy. Pre-ordering will ensure to a great extent that customers' orders are submitted before they enter the shop [7].

Another advantage of introducing an app is that the coffee owners can leverage user data to make more informed decisions in the future. Users can be tracked via their emails and this can help coffee owners to track users more efficiently and do targeted marketing. Usually the cost of building an app can be in a range of $40,000 - $60,000 for basic features [8], this cost can be curtailed if the shop partners with a food delivery platform as the menu and pre-ordering can be done there. More on this in the coming section.

Possible bundles: Further to this, as morning hours are the most popular time with the most traffic, people who are in the coffee shop might select different options to buy which can lead to congestion or increased time to order, lowering the efficiency of the coffee shop to increase the per-minute sales. One solution that might help to improve efficiency here is to do Bundle sales.

As food and coffee are complementary products that people usually purchase together, we used association rule mining to find the most frequently purchased food and coffee in the morning.

Item Pairs	Support	Lift	Count
Coffee: Cappucino Food: Lenka Bar	0.013	1.36	230
Coffee: Latte Food: Donut	0.016	1.06	280
Coffee: Cappuccino Food: Croissant	0.026	1.02	474

We can create bundles of these items so that people don't have to think much to choose between different options. Not only this, we can offer bundling prices, thus giving customers more reasons to choose bundles, which in turn will raise the coffee shop sales.

To offer a competitive bundling price, we analyzed the data and performed various calculations using the average base prices of different items. Hence, the price of a Cappuccino is $4.75 and the price of a Croissant is $3.75. To ease calculation, we made the following assumptions.

1. A customer's reservation price for each item follows the normal distribution with the mean of the current price and standard deviation of $2.24 (it's the standard deviation of item prices)
2. A customer would purchase the combo if the reservation prices for both items are greater than the individual bundle price. For example, if the customer was willing to pay up to $8 for the $4.74 item and up to $5 for the $3.75 item, a reasonable customer would purchase the combo.
3. If a customer's reservation price for one item is greater than the individual price but less for the other item, the customer would select the combo only if the difference between the bundling price and the individual price of the item with the higher reservation price is greater than the reservation price of the other item. For example, if a customer was willing to pay up to $8 for the $4.74 item but only up to $3 for the $3.75 item, a reasonable customer would purchase the combo only if the difference between the bundling price and $4.75 is lower than $3 (the reservation price of the $3.75 item).
4. Otherwise, a customer would only purchase either of the two items or none based on their reservation prices.

Item Pairs	Bundle Price
Coffee: Cappucino Food: Lenka Bar	$7.99
Coffee: Latte Food: Donut	$7.98
Coffee: Cappuccino Food: Croissant	$7.96

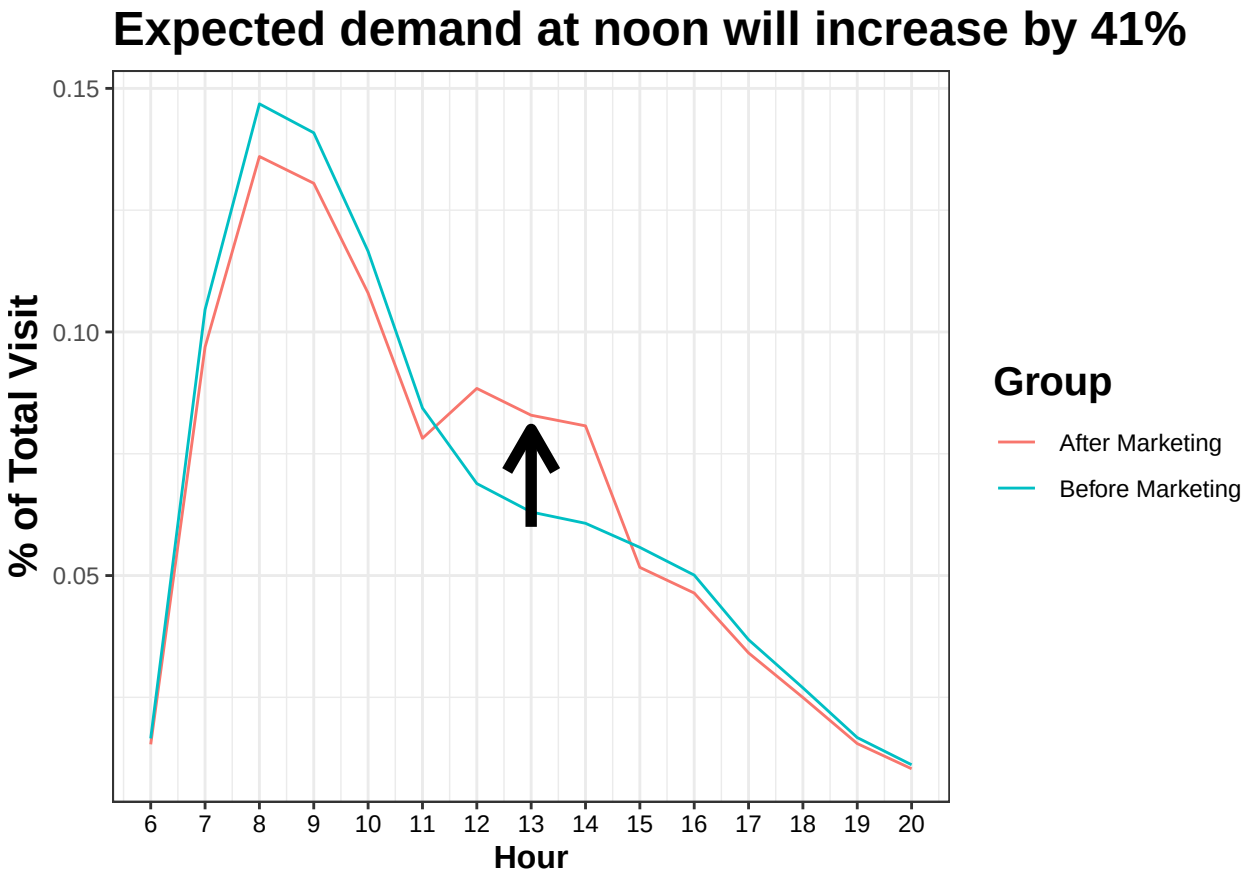
Afternoon

Offering Coupons: Since the morning is a naturally popular time, the coffee shop can leverage this popularity to improve sales in the afternoon. Customers that purchase a coffee in the morning will receive a coupon valid only in the afternoon. This encourages customers to return later in the day when traffic is considerably lower.

Delivery Service: Coupons alone are not necessarily enough to bring customers back. Since the loyal customer group is mostly commuters, it might be inconvenient for them to leave work to go get coffee. To offset this, we suggest coffee shop owners to partner with food-delivery platforms to offer coffee - and possibly food - deliveries. Convenience is valued among customers and deliveries will provide extra motivation to order during Central Perk's off-peak hours [9] [10].

In case the option is feasible, we can offer a free delivery service around midday (12 PM - 2 PM) or reduction in the delivery costs equal to the amount of coupons to improve the accessibility for the loyal customers.

An experiment might be conducted to see how effective this strategy is and whether it can achieve the sales of break-even point or beyond. If this strategy can attract 20% of the morning commuters back to consume in the noon, the demand in noon will increase by 41% and daily sales will increase by 19%.



Limited Discount: Discounting has long been used to incentivize customers and prospects to make a purchase. Therefore, to increase afternoon sales, the coffee shop can also make a discount for certain items around the afternoon. Discount on every item with the highest discount amount is not ideal, although it might drum up more sales, but it will eat out the profit and even hurt the bottom line in the long run. Therefore we did an analysis to choose the ideal items for discounts during noon to boost sales.

Based on our analysis on Purchase quantity and discount, we found Drip Coffee and Mocha is the most price sensitive, decrease one dollar of Drip coffee is associated with 16% more sales and decrease one dollar of Mocha price is associated with 20% more sales.

Conclusion

Morning commuters make up a large portion of the loyal customers whose visiting frequencies are high in the morning and low in the afternoon. In order to generate more revenue from loyal customers and increase the coffee shop operating efficiency, we developed different strategies for different times during the day:

- Morning
- Pre-Order service
- Bundle Sales of Cappuccino & Croissant, Latte & Doughnut, Cappuccino & Lenka bar
- Afternoon
- Coupons for whomever purchased coffee in the morning
- Free delivery service
- Limited Discounts on Drip Coffee & Mocha

By implementing the above strategies, the coffee shop can largely smooth loyal customer demand throughout the day, improve its operating efficiency, and increase customer satisfaction

References

[1] The Value of Keeping the Right Customers, Amy Gallo, https://hbr.org/2014/10/the-value-of-keeping-the-right-customers
[2] https://medium.com/designrover/the-9-minute-takeaway-coffee-67045d359b57
[3] How Restaurants Can Profit from Taking Food Pre-Orders, Andreea Dobrila, https://www.gloriafood.com/food-pre-order-for-restaurants
[4] Restaurants and Consumers Benefit from a Mobile Ordering App, Andrew Gazdecki, https://smallbiztrends.com/2016/10/mobile-ordering-app-benefits.html
[5] https://www.csmonitor.com/Business/Saving-Money/2015/0811/Fast-food-chains-offer-pre-ordering.-Does-it-really-save-time
[6] https://www.slideshare.net/brtheiss/starbucks-wait-time-analysis-21621669/53-Conclusions_About_Time_to_Drink
[7] Essential Features of Successful Coffee Shop Apps, Vasily Malyshev, https://messapps.com/allcategories/development/features-of-coffee-shop-apps/
[8] https://www.businessofapps.com/app-developers/research/app-development-cost/
[9] Restaurant takeout and delivery are taking a bite out of dine-in traffic, https://www.nrn.com/sponsored-content/restaurant-takeout-and-delivery-are-taking-bite-out-dine-traffic
[10] 9 IN 10 US FOOD DELIVERY SERVICE USERS SAY IT MAKES THEIR LIVES EASIER, Mintel, https://www.mintel.com/press-centre/food-and-drink/9-in-10-us-food-delivery-service-users-say-it-makes-their-lives-easier